

What is claimed:

1. (Original) A method for encoding a digital signal into a scalable bitstream comprising:

quantizing the digital signal, and encoding the quantized signal to form a corelayer bitstream;

performing an error mapping based on the digital signal and the corelayer bitstream to remove information that has been encoded into the corelayer bitstream, resulting in an error signal;

bitplane coding the error signal based on perceptual information of the digital signal, resulting in an enhancementlayer bitstream, wherein the perceptual information of the digital signal is determined using a perceptual model; and

multiplexing the corelayer bitstream and the enhancementlayer bitstream, thereby generating the scalable bitstream.

2. (Original) The method of claim 1, further comprising:

transforming the digital signal into a suitable domain, wherein the transformed signal is quantized to form the quantized signal before encoding the quantized signal.

3. (Currently amended) The method of claim 1 ~~or 2~~, wherein the perceptual information of the digital signal is further multiplexed with the corelayer bitstream and the enhancementlayer bitstream to generate the scalable bitstream.

4. (Original) The method of claim 2, wherein the digital signal is transformed to a transformed digital signal using an integer Modified Discrete Cosine Transform.

5. (Original) The method of claim 4, wherein the transformed signal is normalized to approximate the output of a MDCT filterbank.

6. (Currently amended) The method of Claim 1 ~~any one of claims 1 to 5~~, wherein the digital signal or the transformed digital signal is quantized and encoded according to the Moving Pictures Expert Group (MPEG) Advanced Audio Coding (AAC) specification.

7. (Currently amended) The method of Claim 1 ~~any one of claims 1 to 6~~, wherein the error mapping is performed by subtracting the lower quantization threshold corresponding to each quantized value of the quantized signal from the digital signal or the transformed digital signal, thereby generating the error signal.

8. (Currently amended) The method of Claim 1 ~~any one of claims 1 to 7~~, wherein the psychoacoustic model is used as the perceptual model for determining the perceptual information of the digital signal.

9. (Currently amended) The method of Claim 1 ~~any one of claims 1 to 8~~, wherein the error signal is represented in bitplanes comprising a plurality of bitplane symbols, and wherein the bitplanes are shifted based on the perceptual information of the digital signal, such that bitplanes which are more perceptually important are coded first when the bitplanes are scanned and coded in a consecutive sequence during bitplane coding of the error signal.

10. (Currently amended) The method of Claim 1 ~~any one of claims 1 to 8~~, wherein the error signal is represented in bitplanes comprising a plurality of bitplane symbols, and wherein the bitplanes and the bitplane symbols are scanned and coded during bitplane coding of the error signal in a sequence based on the perceptual information of the digital signal, such that bitplane symbols of the bitplanes which are more perceptually important are coded first.

11. (Currently amended) The method of claim 9 ~~or 10~~, wherein at least one of the following information is determined as the perceptual information of the digital signal by the perceptual model:

the bitplane of the error signal which the bitplane coding of the error signal starts $M(s)$; and

the Just Noticeable Distortion (JND) level of the digital signal, wherein s correspond to a frequency band of the digital signal or the transformed digital signal.

12. (Original) The method of claim 11, wherein perceptual significance $P_s(s)$ of the digital signal is further determined as the perceptual information, the perceptual significance is determined by:

determining the bitplane of the error signal corresponding to the JND level of the digital signal,

subtracting the bitplane of the error signal corresponding to the JND level of the digital signal from the bitplane of the error signal which the bitplane coding of the error signal starts $M(s)$, thereby determining the

perceptual significance $P_s(s)$, wherein the perceptual significance $P_s(s)$ is used to control the scanning and coding sequence of at least the bitplanes or the bitplane symbols of the bitplanes.

13. (Original) The method of claim 12, wherein the perceptual significance $P_s(s)$ is normalized by:

defining a common perceptual significance $P_s(s)_{\text{common}}$
based on a function of the perceptual significance $P_s(s)$;
and

subtracting the common perceptual significance $P_s(s)_{\text{common}}$
from the perceptual significance $P_s(s)$, thereby
generating the normalized perceptual significance $P_s'(s)$,

wherein for frequency band s for which the quantized values
are not all zero, the value of the perceptual
significance $P_s(s)$ is set to the value of the common
perceptual significance P_s_{common} , and

wherein for frequency band s for which the quantized values
are all zero, the normalized perceptual significance
 $P_s'(s)$ is multiplexed with the corelayer bitstream and
the enhancementlayer bitstream to generate the scalable
bitstream.

14. (Original) The method of claim 11, wherein the bitplane of the error signal which the bitplane coding of the error signal starts is determined from the maximum quantization interval used in the frequency band s for quantizing the digital signal or the transformed signal.

15. (Original) A encoder for encoding a digital signal into a scalable bitstream, comprising:

a quantization unit for quantizing the digital signal, and encoding the quantized signal to form a corelayer bitstream;

an error mapping unit for performing an error mapping based on the digital signal and the corelayer bitstream to remove information that has been encoded into the corelayer bitstream, resulting in an error signal;

a perceptual bitplane coding unit for bitplane coding the error signal based on perceptual information of the digital signal, resulting in an enhancementlayer bitstream, wherein the perceptual information of the digital signal is determined using a perceptual model; and

a multiplexing unit for multiplexing the corelayer bitstream and the enhancementlayer bitstream, thereby generating the scalable bitstream.

16. (Original) A computer readable medium, having a program recorded thereon, wherein the program, when executed by a computer, makes the computer perform a procedure for encoding a digital signal into a scalable bitstream, the procedure comprising:

quantizing the digital signal, and encoding the quantized signal to form a corelayer bitstream;

performing an error mapping based on the digital signal and the corelayer bitstream to remove information that has

been encoded into the corelayer bitstream, resulting in an error signal;

bitplane coding the error signal based on perceptual information of the digital signal, resulting in an enhancementlayer bitstream, wherein the perceptual information of the digital signal is determined using a perceptual model; and

multiplexing the corelayer bitstream and the enhancementlayer bitstream, thereby generating the scalable bitstream.

17. (Original) A computer program element which, when executed by a computer, makes the computer perform a procedure for encoding a digital signal into a scalable bitstream, the procedure comprising

quantizing the digital signal, and encoding the quantized signal to form a corelayer bitstream;

performing an error mapping based on the digital signal and the corelayer bitstream to remove information that has been encoded into the corelayer bitstream, resulting in an error signal;

bitplane coding the error signal based on perceptual information of the digital signal, resulting in an enhancementlayer bitstream, wherein the perceptual information of the digital signal is determined using a perceptual model; and

multiplexing the corelayer bitstream and the enhancementlayer bitstream, thereby generating the scalable bitstream.

18. (Original) A method for decoding a scalable bitstream into a digital signal comprising:

demultiplexing the scalable bitstream into a corelayer bitstream and an enhancementlayer bitstream;

decoding and dequantizing the corelayer bitstream to generate a corelayer signal;

bitplane decoding the enhancementlayer bitstream based on perceptual information of the digital signal; and

performing an error mapping based on the bitplane decoded enhancementlayer bitstream and the dequantized corelayer signal, resulting in a reconstructed transformed signal, wherein the reconstructed transformed signal is the digital signal.

19. (Original) The method of claim 18, further transforming the reconstructed transformed signal into a reconstructed signal, wherein the reconstructed signal is the digital signal.

20. (Currently amended) The method of claim 18 ~~or 19~~, wherein the perceptual information of the digital signal is obtained from the demultiplexing of the scalable bitstream.

21. (Currently amended) The method of claim 19 ~~or 20~~, wherein the corelayer signal and the enhancementlayer signal are transformed using an integer Modified Discrete Cosine Transform (MDCT).

22. (Currently amended) The method of Claim 18 ~~any one of claims 18 to 21~~, wherein the corelayer bitstream is decoded and dequantized according to the Moving Pictures Expert Group (MPEG) Advanced Audio Coding (AAC) specification.

23. (Currently amended) The method of Claim 18 ~~any one of claims 18 to 22~~, wherein the error mapping is performed by adding the lower quantization threshold used for dequantizing the transformed signal and the bitplane decoded enhancementlayer bitstream, thereby generating the enhancementlayer signal.

24. (Currently amended) The method of Claim 18 ~~any one of claims 18 to 23~~, wherein the enhancementlayer bitstream is bitplane decoded to generate a plurality of bitplanes comprising a plurality of bitplane symbols in a consecutive sequence, and the bitplanes are shifted based on the perceptual information of the digital signal to generate the bitplane decoded enhancementlayer bitstream.

25. (Currently amended) The method of Claim 18 ~~any one of claims 18 to 23~~, wherein the enhancementlayer bitstream is bitplane decoded to generate a plurality of bitplanes comprising a plurality of bitplane symbols in a sequence based on the perceptual information of the digital signal, thereby generating the bitplane decoded enhancementlayer bitstream.

26. (Currently amended) The method of claim 24 ~~or 25~~, wherein at least one of the following information is received as the perceptual information of the digital signal:

the bitplane which corresponds to the enhancementlayer bitstream when the bitplane decoding of the

enhancementlayer bitstream starts, which bitplane is specified by a number $M(s)$; and

the Just Noticeable Distortion (JND) level of the digital signal, wherein s correspond to a frequency band of the digital signal.

27. (Original) The method of claim 26, wherein the bitplane which corresponds to the enhancementlayer bitstream when the bitplane decoding of the enhancementlayer bitstream starts $M(s)$ is determined from the maximum quantization interval used in the frequency band s for dequantizing the corelayer bitstream.

28. (Original) A decoder for decoding a scalable bitstream into a digital signal comprising:

a demultiplexing unit for demultiplexing the scalable bitstream into a corelayer bitstream and an enhancementlayer bitstream;

a dequantization unit for decoding and dequantizing the corelayer bitstream to generate a corelayer signal;

a bitplane decoding unit for bitplane decoding the enhancementlayer bitstream based on perceptual information of the digital signal; and

an error mapping unit for performing an error mapping based on the bitplane decoded enhancementlayer bitstream and the dequantized corelayer signal, resulting in a reconstructed transformed signal, wherein the reconstructed transformed signal is the digital signal.

29. (Original) A computer readable medium, having a program recorded thereon, wherein the program, when executed by a computer, makes the computer perform a procedure for decoding a scalable bitstream into a digital signal, the procedure comprising:

demultiplexing the scalable bitstream into a corelayer bitstream and an enhancementlayer bitstream;

decoding and dequantizing the corelayer bitstream to generate a corelayer signal;

bitplane decoding the enhancementlayer bitstream based on perceptual information of the digital signal; and

performing an error mapping based on the bitplane decoded enhancementlayer bitstream and the dequantized corelayer signal, resulting in a reconstructed transformed signal, wherein the reconstructed transformed signal is the digital signal.

30. (Original) A computer program element which, when executed by a computer, makes the computer perform a procedure for decoding a scalable bitstream into a digital signal, the procedure comprising:

demultiplexing the scalable bitstream into a corelayer bitstream and an enhancementlayer bitstream;

decoding and dequantizing the corelayer bitstream to generate a corelayer signal;

bitplane decoding the enhancementlayer bitstream based on perceptual information of the digital signal; and

performing an error mapping based on the bitplane decoded enhancementlayer bitstream and the dequantized corelayer signal, resulting in a reconstructed transformed signal, wherein the reconstructed transformed signal is the digital signal.